Notebook, N-87-12-10.1

This notebook covers the period December 1887-November 1889. All entries are by Edison. The book contains drawings and several long notes relating to filament experiments. There are also phonograph drawings; notes on battery solutions; and notes, drawings, and cost calculations regarding ore milling and hydroelectric power production at Niagara Falls. On the inside back cover is a list of points to include in an electric railway caveat. The pages are unnumbered. Approximately 120 pages have been used.

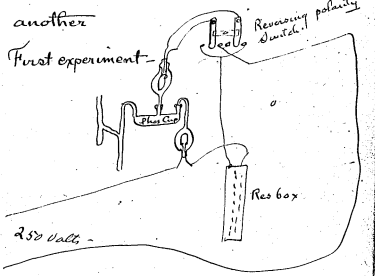
XE 172 N-8712.10.1

Orange Dec 10 1887 (Edison, S.A.) 4

Lamp experiments -

New process for coating the filiment in the lamp with a deposit of very shiny carbon by means of electrical carrying from one filiment to another

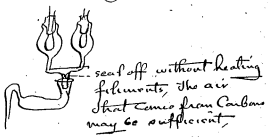
First experiment -



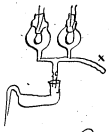
Both lamps are in series, by using a low vacuum, so low that the close hugging blue disappears and goes up on the carbon, then the deposit will take place on one side of the carbon by reversing the other side can be deposited on. This carbon comes by electrical carrying from the other lamp. With a high vacuum the blue spreads out on clamp as vacuum gets lower it hugs the clamp closely, with a stiff lower vacuum (ie) poorer vacuum part of the blue goes up on the carbon near the clamp & with a stiff poorer vacuum it can be made to run up over 1/2 the filament — With two filaments

in the globe both in series the whole of the carbon deposited on one will come from the other. while if only one filament were used one side would be injured for the benefit of the other & no benefit would be obtained — as it would be expensive to put two filaments in the globe so as to use one for depositing on the other, I want to ascertain by experiment if the filaments can be seperated in different lamps & the deposit still take place through the narrow bores in the exhaust tube, you will also ascertain if making one or the other lamps the brightest produces any better results —

The poor vacuum can probably be obtained but not heating either lamp until a moderate vacuum is obtained and then running them up quickly – If the pumps exhaust the air too quickly to get any deposit then arrange the lamps thus



If this doesnt answer – arrange lamps thus



is a tube containing Cyanide of silver after sealing off the lamps you

Can manipulate the vacuum that is to say cautiously reduce the vacuum by gently heating the Cyanide, but before doing so work the lamps up on the Rose box until you have reduced the Vacuum by excluding the air, This will give you a blue halo on clamps if it doesnt run up on Carbon you can then heat the Cyanide cautiously watching the blue until it disappears up on the Carbon, then keep on Current for say ½ hour & then take it off & notice if one side or the whole of one filament looks more shining than the other — If one shows only a shine near the clamp on one side, then the Vacuum is

not poor enough and the Cyanide must again be heated, The 2nd heating may have to be higher to drive off the Cyanogen — You better make say 3 this way & if it fails - then use method of Cyanide of Silver. Use in tube. Peach Blossom Colored Oxyquichloride of Chromium This gives off Chlorine by heating If this tried on 2 or 3 lamps fails - then put in tube Silver Carbamide which gives on heating ammonia —

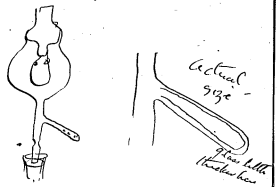
If these two lamps do not work ~~make 1 or 2 dog lamps with two filaments using posts~~

Cut the current off and manipulate one to get a deposit on one side, at Menlo park Our vacuums were so low at one time that out of 50 16 Cp lamps set up at 40 candles over 15 of them after a few hours showed one side dead black while the other side was like polished silver This shows that it is possible, but whether it is possible to cause this carrying to go so long a distance from one lamp to the other is the object of the Experiment, by using two filiments they act as one long filiment hence one filiment will be coated white the other will get black one acting as one side

when the vacuum at Menlo in those
50 lamps was a little better than
the deposit of carbon took place
on the clamp which was soon
covered with bushy lamp black like
carbon. so you see there is a
critical point in this experiment.
If you succeed in accomplishing
the deposit either by two separate
lamps or two filaments in one
lamp - you should make 1/2
doz & then put them back on
pump & get high vacuum
& set the shiny carbons up -
for a life test,

Orange Dec 10 84 —

Make 25 Regular lamps (new) with paste clamps & side tube thus



Run them to high vacuum work filaments in the regular way put Cyanide of Silver in side tube — heat this only gently to drive off any water, but not high enough to break tube up much — then seal them off — After they are off divide them in 5 series of 5 Each — Run these up to

Say 50 Candles in photometer
you get a blue
then heat the Cyanide tube
until the blue appears if it fails
to appear at 50 Candles — if you
can do it at lower cp than 50
do so [I want to never go
above normal after I have the
Cyanogen gas in vacuum — if
you run too high it will
decompose Cy & deposit Carbon
Cyanogen takes a very high
incandescence to decompose — very
much higher than a hydrocarbon
hence I hope to use it as a residual
at normal cp without decomposing
it.] Then keep heating Cyanide
until the blue is rather close
to clump (not spread in a ball)
do this to each of the 1st series

To the 2nd series. go through same process but heat cyanide until Glue is a close hugging one & small —

To third series continue this further until 1/2 the Glue is on Clamp & half on Carbon

to 4th series heat until all on Carbon

To last series heat until the last action takes place & considerable beyond —

Do not hold the lamp at the high Cps only for an instant at a time so you can see where the Glue is —

Set all the series up at 16 Cp & take Cpower Every day on all —

Duplicate all these Experiments
Except use in side tube, Sesquichloride
of Chromium -

Duplicate again using Hydrogen
the same as we used in Howell
Room when Barker was there,

Duplicate again using an
anhydrous Bromide of some
metal which on heating gives
off only Bromine.

Note - perhaps a U tube with
mercury could be attached to each
lamp & thus accurately measure
Vacuum - or a stop cock & U
tube on pump could be used
with large heating tube
~~by means~~ suit your own
ideas as to convenience -

Orange Dec 10 1887

Experiments on depositing on filaments materials other than Carbon —

Use lamps with side tubes and work them regular way & high vacuum then seal off & by heating the side tubes drive off the compound or compound gas. while the filament is brought up to various incandescences to decompose the gas & deposit the solid ingredient —

make 3 lamps each with following substances —

Tri-bromide of Silicon,
Crystals which sublime at 240 cent.
See Watts 2nd Sup p 1086

Bromide of Zirconium $ZrBr_4$

Volatile at heat of gas burner -
Watts 2nd Sup p 1215

Iodide Silicon, tetraiodide, Melts at
120 Cent, boils, 200 Cent.

Sesquiiodide of Silicon Melts 250 C

Ammonio-Chloride, Boron —

Hydrocyanate of Titanic Chloride
This deposits Nitride of Titanium which is a
non conductor & infusible — See Gmelin
Organic Vol 2 p 148 —

It may require very high incandescence
to deposit some of these compounds —
Some of them may reduce the resistance
of the filament greatly — what I
want is brilliancy of surface —

Hexafluoride of Chromium —

Made in side tube. 4 parts Chromate Lead 3 pts fluor spar 150 mesh each & ground together & 8 parts strong sulphuric acid — heat after vacuum obtained & Good red gas comes off, but perhaps you wont notice gas in vac

Keep the filament burning rather high white gas coming off but I expect the gas will attack the glass, while dry fluorine resulting from the decomposition does not touch glass

Pentachloride Molybdenum Melts at 381 Fahr gives dark brown vapor deposit Molybdenum on filament, have you Brother make it

Tungstic Hexachloride Melts at 527 Fahr & probably much lower in vacuum — gives vapor Tungsten deposit on filament, Have you Brother made —

Tungstic Pentachloride melts at 478 Fahr – Have your Brother make –

Osmic Tetrachloride is volatile, See if you can work it – Osmium is the most infusible element known except carbon – If we could get a shiny coat of this on filament we would get 4 times lamps per hp –
Osmium is not fused in the Oxy-hydrogen blowpipe –

See if dry Oxygen attacks the filament, use Red Oxide mercury inside tube get high Vac & then put filament at 16 cp & heat oxide – O is driven off –

I want to continue experiments on the depositing carbon on filiments in tubes, When you are ready speak to me and I will have some well made tubes of iron made with a bottom welded on and a fine thread cap in the tube you place, Charcoal always of same quality. Then use different quantities of the same material, to get different pressures + try various heats – I find that under pressure most hydrocarbons decompose readily at a dull red (10) at a lower temperature than in air –

Try Mellon – Have your Bro make –

Monosulphide of Carbon, C.

Sulphur 20 pct albumen from Egg 80 pcts mixed together –

Aniline Oil – Asphalt, hard Cubain,

Anthracen (purified) – pyrene,

Aniline red – Napthaline,

Paraffine –

From the best results, select one & then we will put 50 new lamp filaments in deposit and put in lamps with paste clamps & run a Curve

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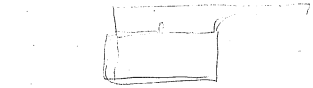
Run off 25 Req new lamps with paste clamps with high Vacuum but do not heat filament until the lamp is sealed from Vacuum pump — Then set 10 lamps up at ~~[illegible]~~ 16 Cp - & take Cp every day also set up 10 at the rate of 240 cp per hp & take Cp. Every day —

Arrange with Mr Ott to have a heating stove with new lamp rack to bake lamps before putting on pumps — also get from Lamp factory their old Exhaust pump & box for taking water out of lamps after baking — how it sex

Bichloride of platinum absorbs mercury vapor — I suppose the Chlorine combines with the Mercury and leaves platinum — try some of this in a dish in a vessel with mercury well covered, see if in time it will absorb mercury vapor —

For depositing Boron on filament which is a substance like carbon & equally infusible — use Boric chloride you Bro. can make the dry powder as described in Watts Dec 2nd Suppl. page 207 — This powder on heating in a side tube in lamp will give off Boric Chloride which will require the filament to be run up to a very high incandescence to decompose —



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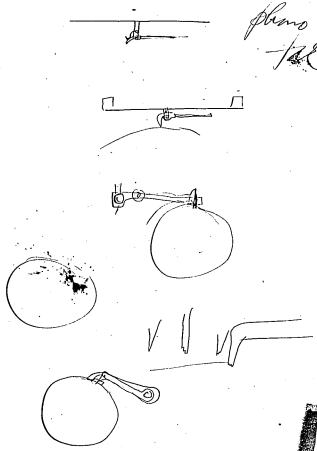
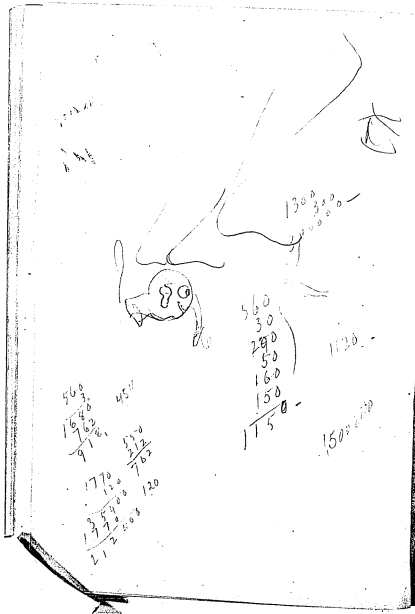
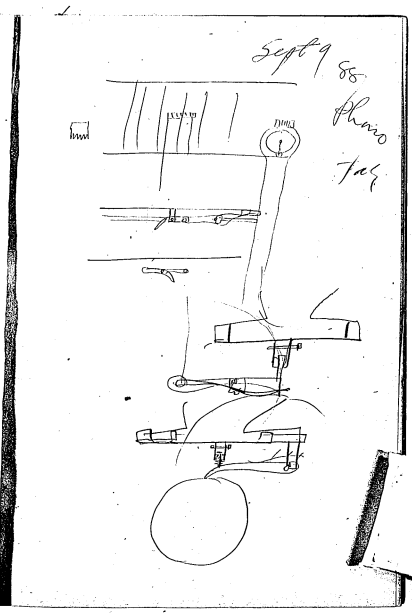
Sept 7 88

Plano



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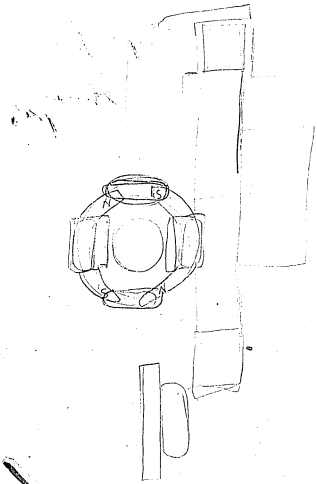

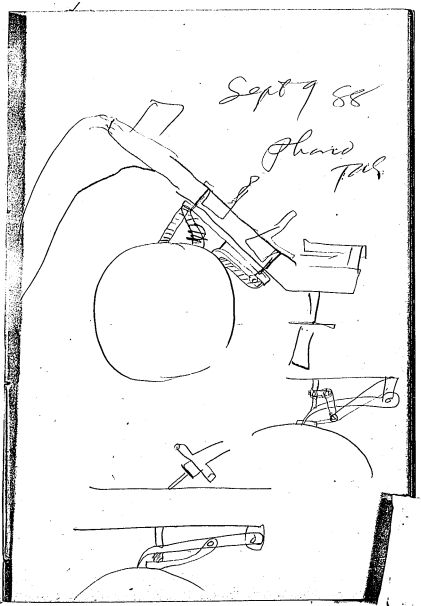
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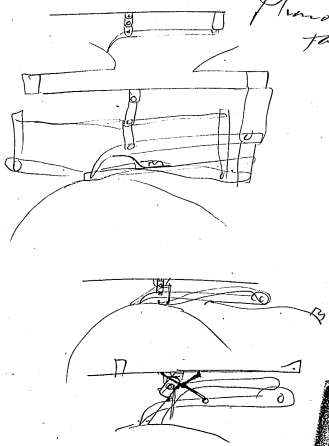

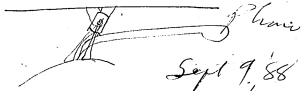

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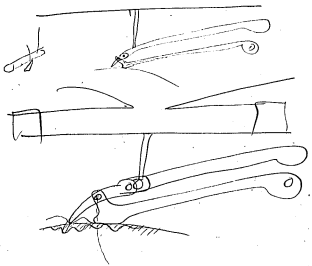

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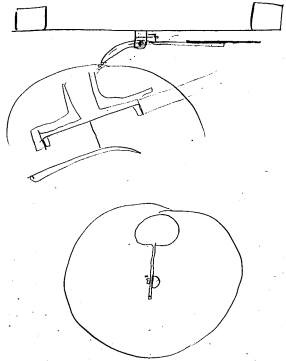

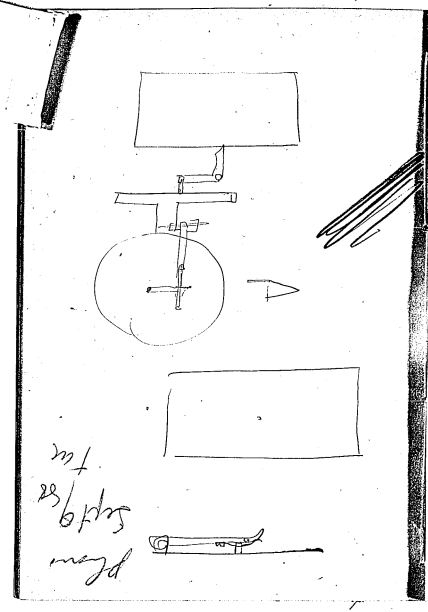
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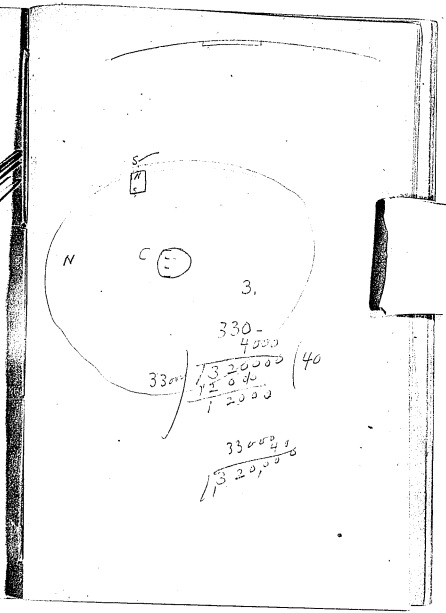
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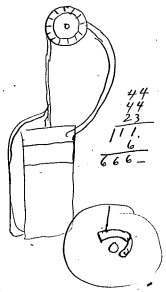

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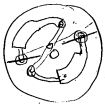

300 feet.	1 lb
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37.5 —	8
19	16
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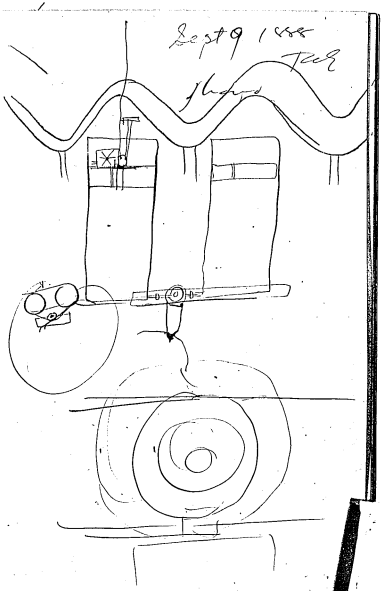
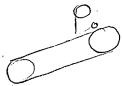
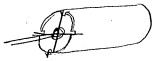
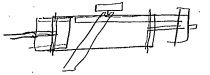
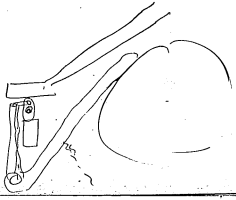
2 1/2	128.

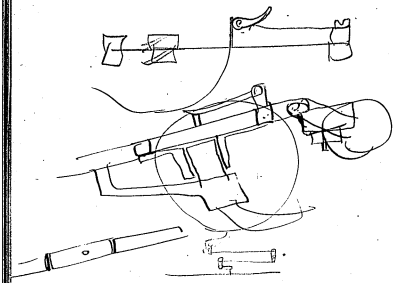












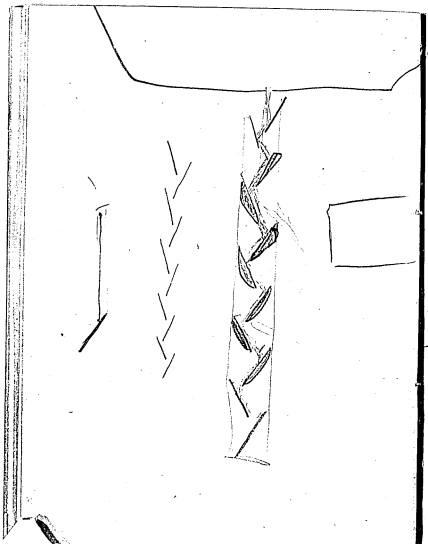
1.20

150 –
37
30
25
20
25
2.87
2.75
5.62

Battery Expts. May 18 1887

Chromate of Lead is insoluble in Hyposulphite Soda

alkaline Sol of Lead oxide is precipitated by alkaline Sols of Chromic stannic stannous antimonious & arsenious Oxides hence Lead oxide say Litharge or red Lead in strong soda saturated with say Chromic oxide showed work with Zinc; or in per oxide plates with Zinc shed work

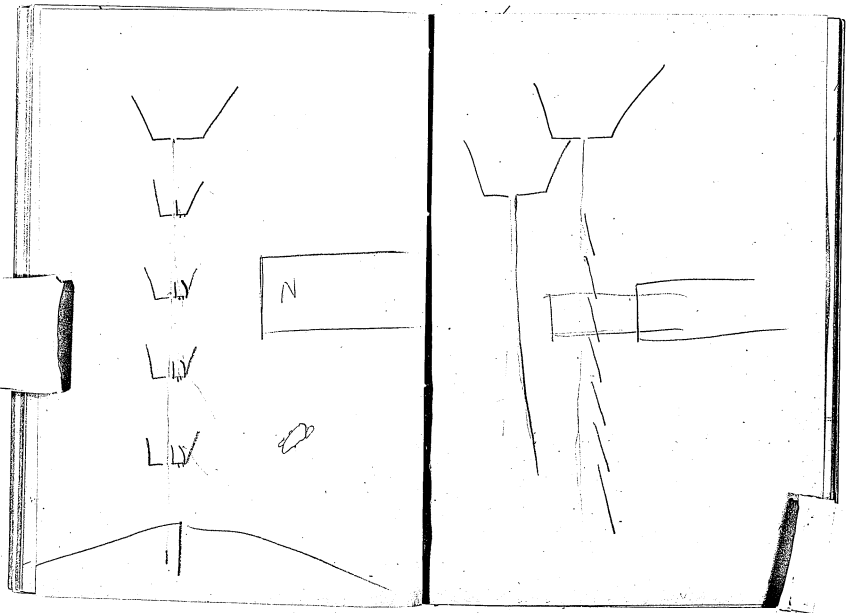


Ormuly

Zinc Bromide combines with Bromide of ammonia to form a double salt which has a specific gravity of 2.628 S S — Quartz without float & glass would sink S S

oh dear the above is a Solid

Conc sol of double Chloride of Zinc & ammonium dissolves Zinc oxide perfectly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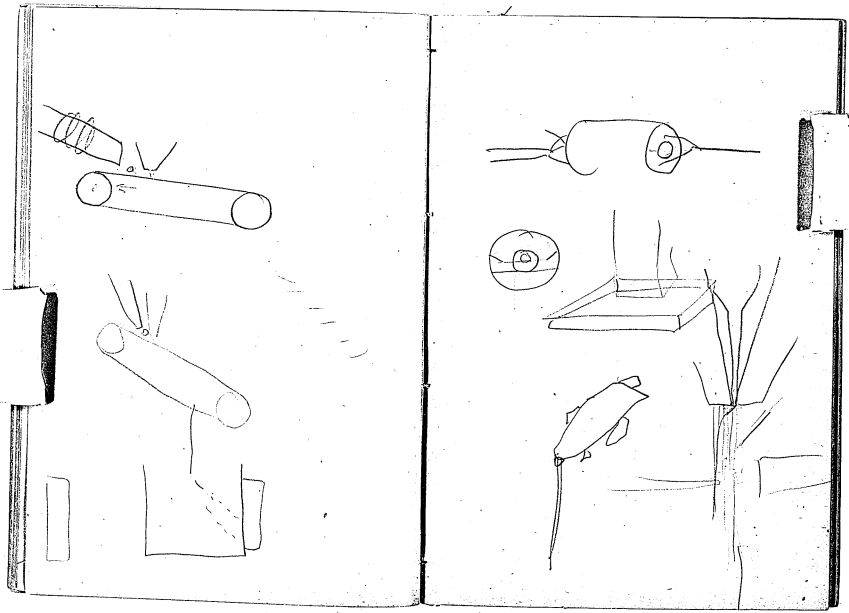

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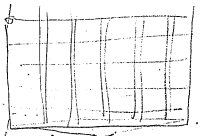

360 lb water second
60
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720.
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1

60 lb water to square foot

60) 414000 (6900
360
54

60.

6900.

115 lbs per second.

60
60
3600.

115
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22410) 30000 (13
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870

Niagara -

Triple Expansion Engines at 3 places in Buffalo -

20000 hp at 24 per hp including Condensers. 480 000

20000 hp boiler at 10 per hp 200.000
piping & setting boilers. 80 000.
3 Bldgs. 180.000.
40 double Dynamos 480.000.
Belts. 20.000.
Chimney Blower & Stokers 30.000
Station Appliances 75.000
Outside mains per pump 35 000

1,895 000
75 000
1,970 000

Water Mains

20 000 at 1½ lb Coal.
22) 30 000 per hour or 13 tons or 130 tons per day
at $2. $260 day 312 days. $81.120.

Coal -	81 120
payroll - Each station	25 540
15 - 7 25 25 10 - 82. 3 Stations	76 500 -
	7 500
Ins 1,500,000	54 000.
	6 000
Genl Mgr	5 000
Presdt	5 000
Supt & Tr	4 000
Electn.	6 000
Oil	1 000
waste.	800
800 pr branch	
Repair armatr Engn & boilrs	8 000
	280,420

280 420. Eng
212 000 WP

Recpts at 9000 at 15 -
+ 9000 at 25 -

Recpts be 360 000.
deduct 280 000
180,000

deducting interest at 6 pct on

1,970,000. 180 000
114,000
leaves 66 000

for stock - or say 6 pct on a Million
to say nothing of added Cost
of Water power investment

Niagara alone bldgs	600,000.
deliver 3 miles	30,000.
Cost conductors. poles etc.	15 000
	645,000,

4 stations.

Running Expense

Pres. & Sec'y	6000	
Sec'y	3000	
Manager & Clerks	6000	
10 hour run. steady power	20000	wages
Outrunners.	3000	
Brushes,	500	
Depen. 3 pot. ind. pipes accumulation 650000	19500	24 20000 / 4 8000
Ins. at .75	5000	
Repairs on line.	2000	

64300
39000
103300

Interest on 650000 bonds
Yearly Running Expenses

20000 Costing) 103 300 (5.16
100 000
3 3 000
20 000
13 000 00

5.16 per year for Electrical part of mills farmed there over motors. If not. Then. 480 000 must be added to investment

	645000
making	480 000
	1,125,000

6 pot. outlay is 675000
Expenses 64300
20000

3 18000 (6.59
2 00000
1 18000
1 00000
18000

or 6.59 per hp —

If sold for $8 per hp at 9, 10 11 1/2 1

gives 160 000
Expense 131 800
281 200
20 000
48
64
104

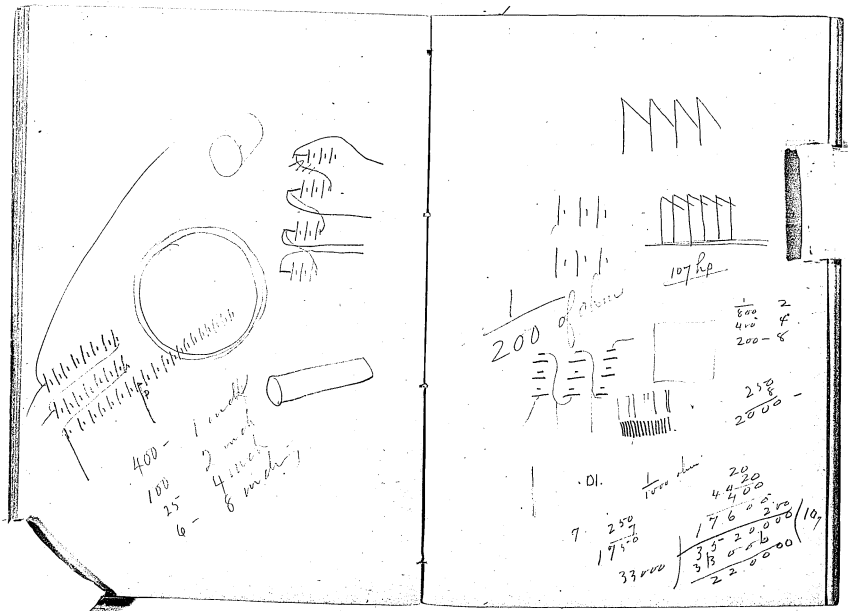
If the parties put in Triple Expansion Engines at ~~at 4~~ They can make their hp in 500 hp lots at following rates. 1 1/2 lbs Coal 750 lbs hour or 7500 lbs per day ten hours. say 4 tons at 250 ton, 10 per day

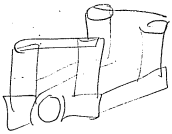
312 days 10 | 500 | 3120 | 6.12 per hp
3000
1200

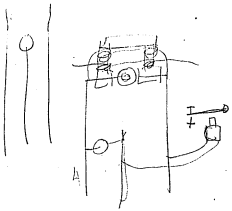
for coal at 1500 for wages, 9.20 cents,

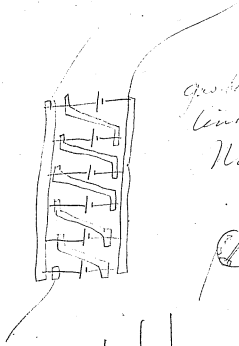
150 | 20000 | 31

20 | 5000 | 12

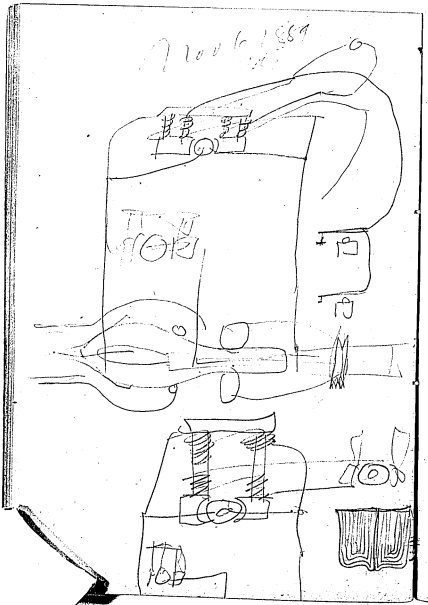

400 - 1 inch
100 2 inch
25 4 inch
6 - 6 inch
10 hp
200 gallons
2000 -
20
4400
176 0 0 200
33 0 0 0 00
22 0 0 00
250
1750
33000



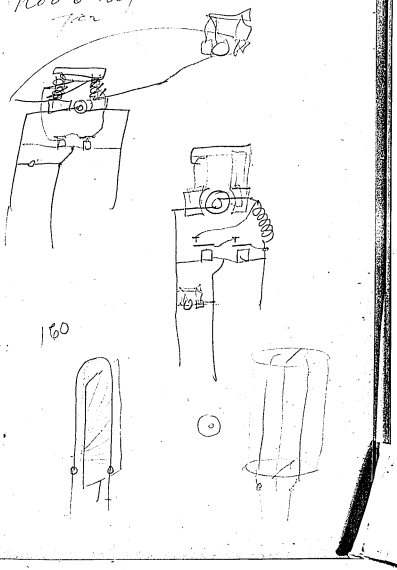


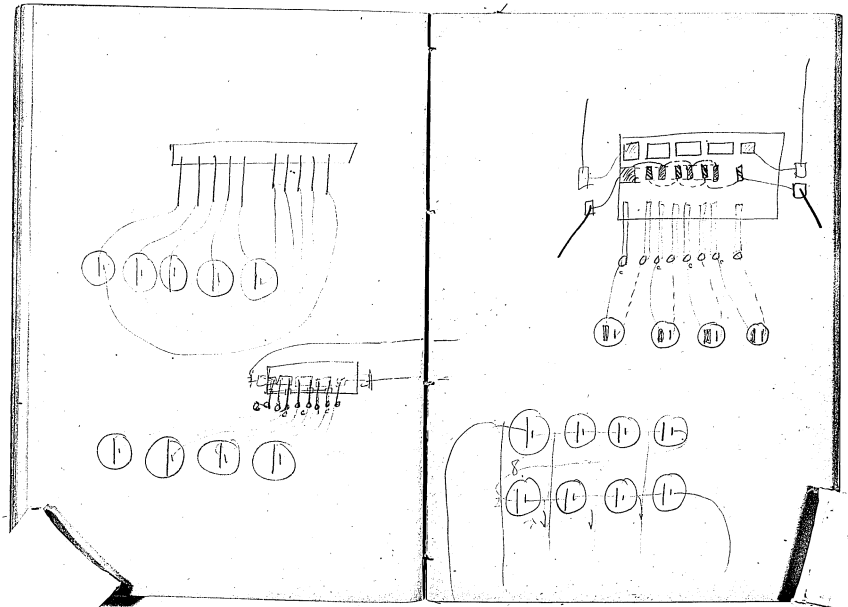

Quadrant
Linear Reducer
Nov 6 1869

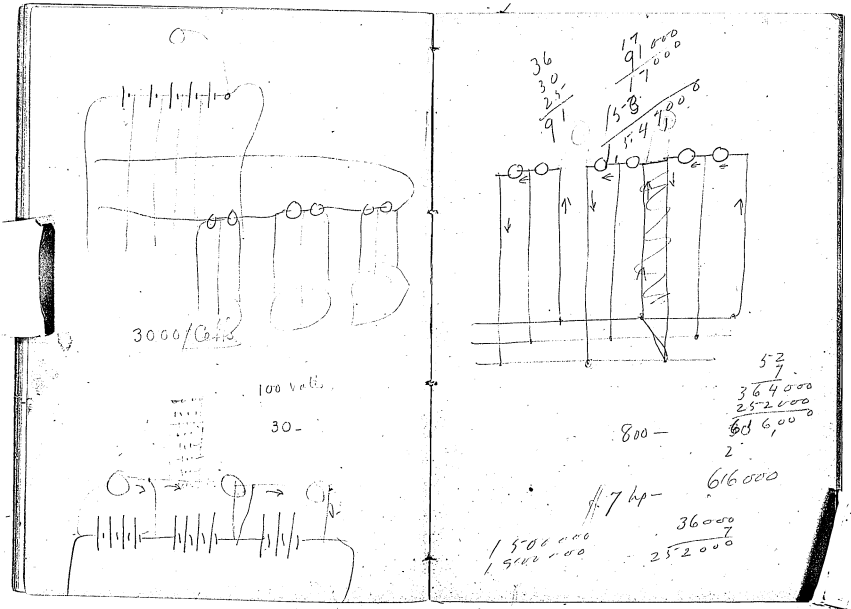
Nov 6 1889

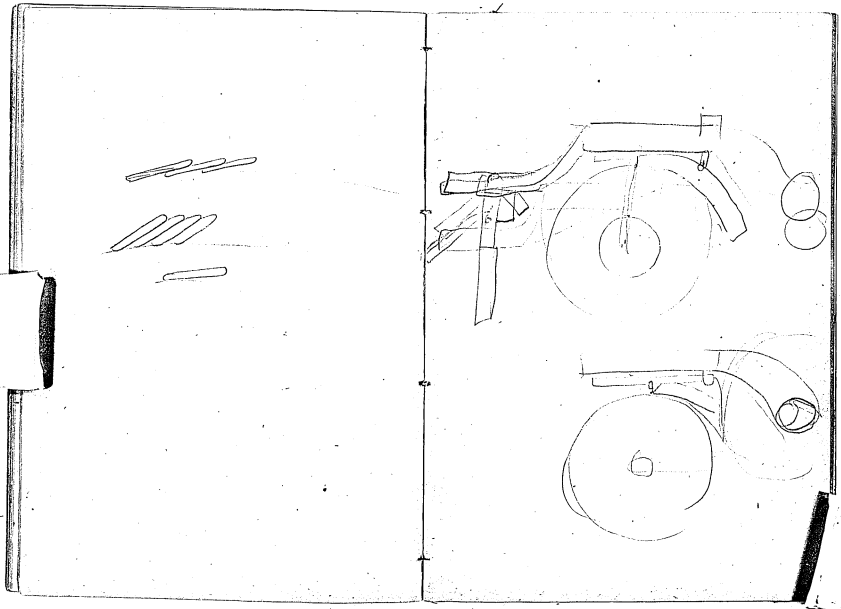


Nov 6 1889






3000/Cells
100 volts
30-
800-
7 hp-
616000
36000
7
252000
1500000
1500000
36
30
25
91
17
91000
17000
153
154700
52
7
364000
252000
616000
2



114
84
456
912
959
1.35

24) 114 (
84
302
252
48

31.85-3

50) 632 (12.6
50
132
100
32

385

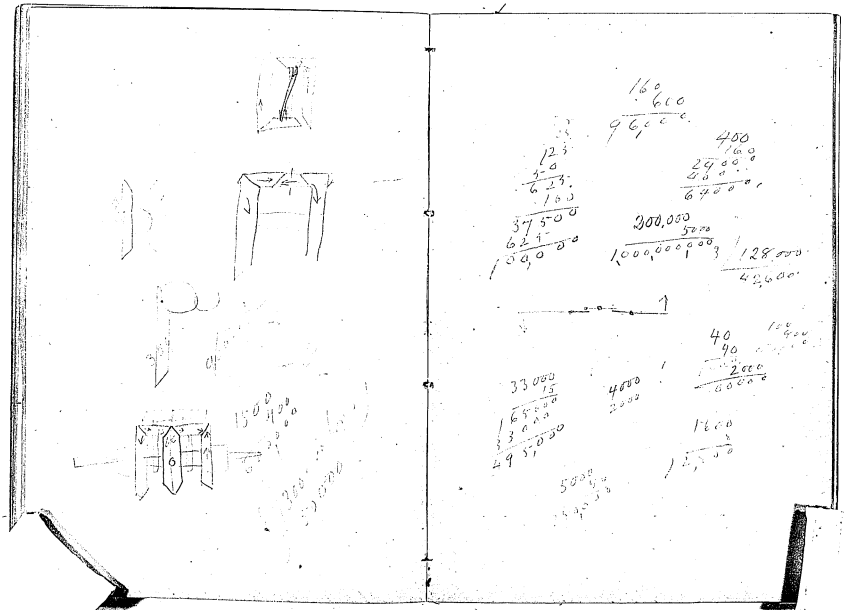
85.

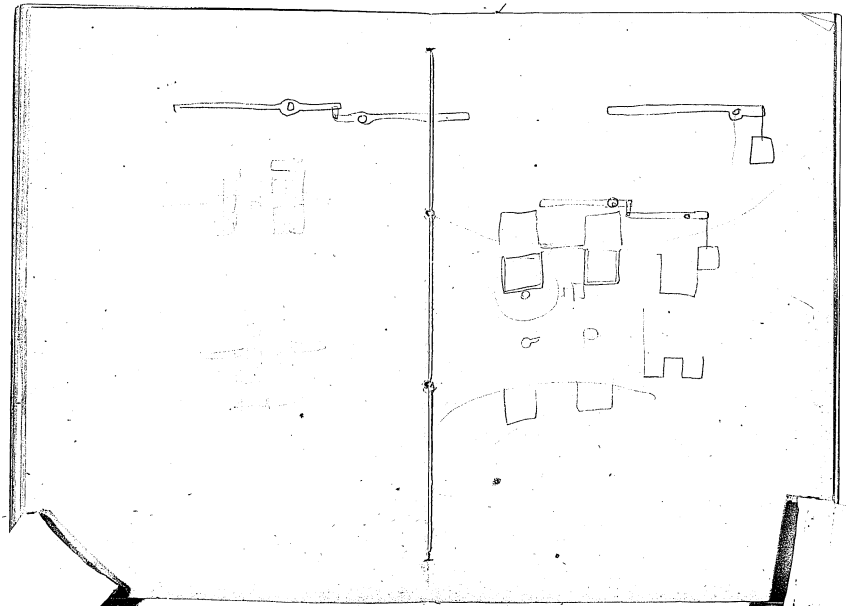
6-
50.4

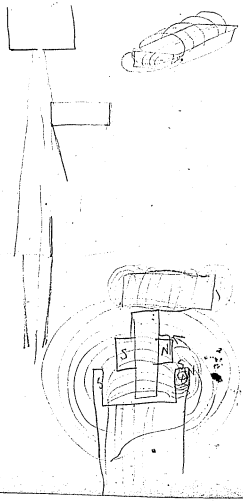
632
50
37.600

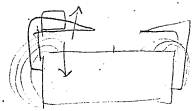
22) 768

133
4
532
84
266
4256
4522









$$\begin{array}{r} 24 \\ 60 \\ \hline 144^{\circ} \end{array}$$

30
25
60 c — 50 mesh —
Running Labor 1.5 c
Water — .3
Wear 3

55 c
14
5
74.

250.
12 175
12
350
175
2100

200 line

5000

25
50
125

33.
1000 1 hp —

74 —
3 Roy
3 Roy
3 gouty
83 —

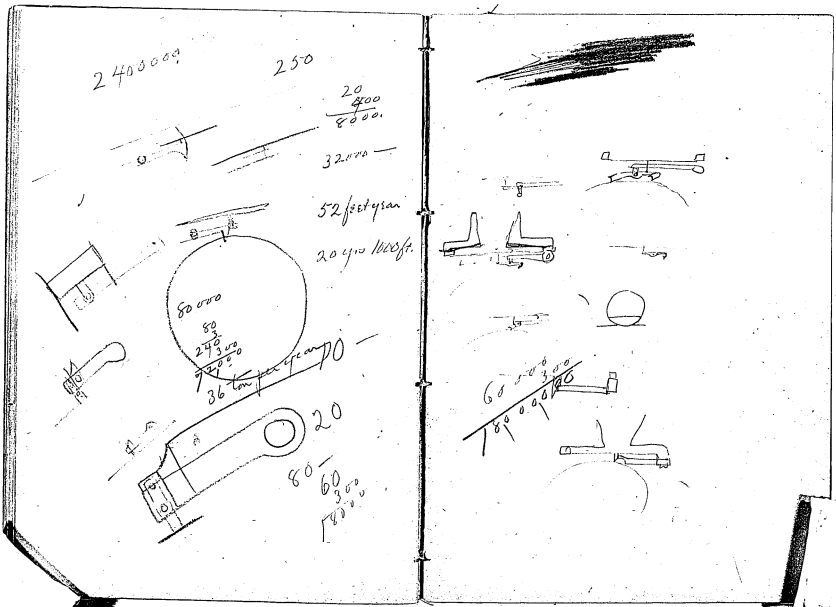
8 10
145 1 to 25 —
290 1 to 125
72
362

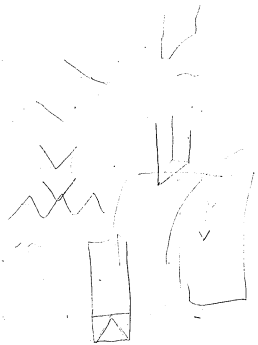
100

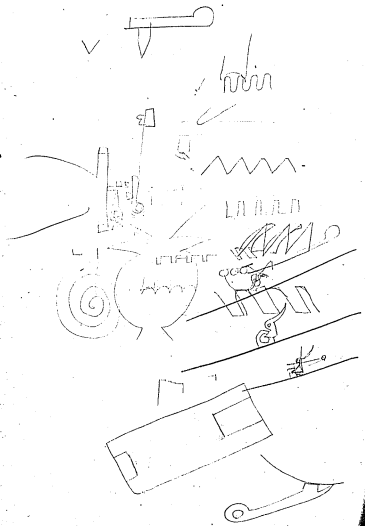
362

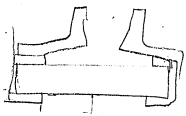
200 ton Cone Drying 10 c
8
Magnet —
Roasting — 1.00.
Regrinding — 50
8 20
Buddling — 100
Matting
5

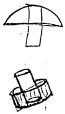
2000 | 28800 (1.44
2000
8800
8000
8000

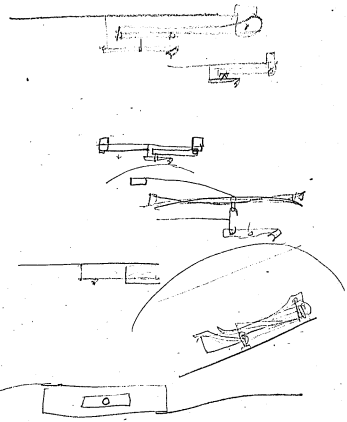

2400000
250
20
4000
8000.
32000
52 feet year
20 year 1000 ft.
80000
80
293000
36 ton per year
20
80
60
300
18000
60
300
18000

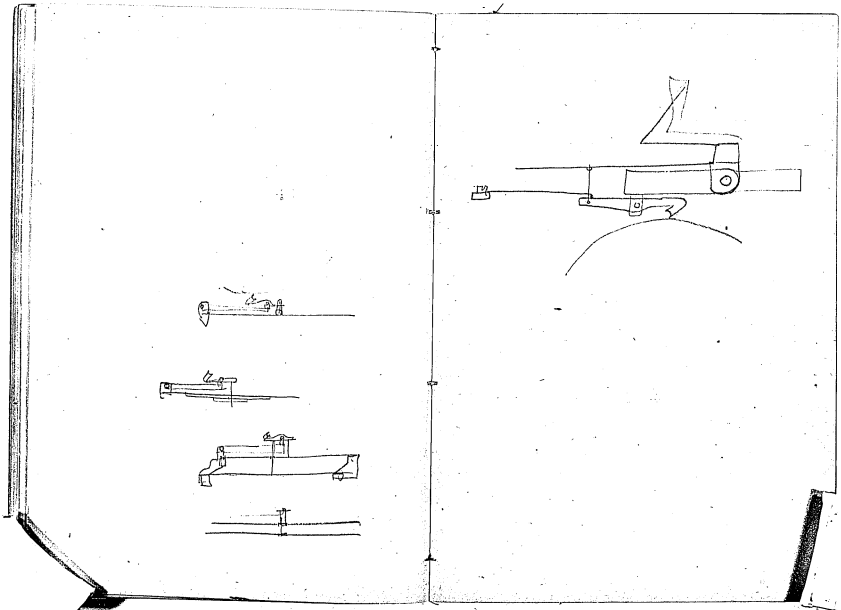












100.
40.
24.
12
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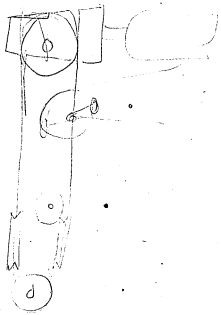
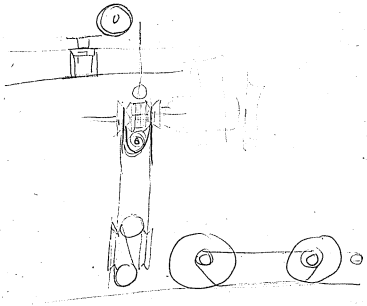
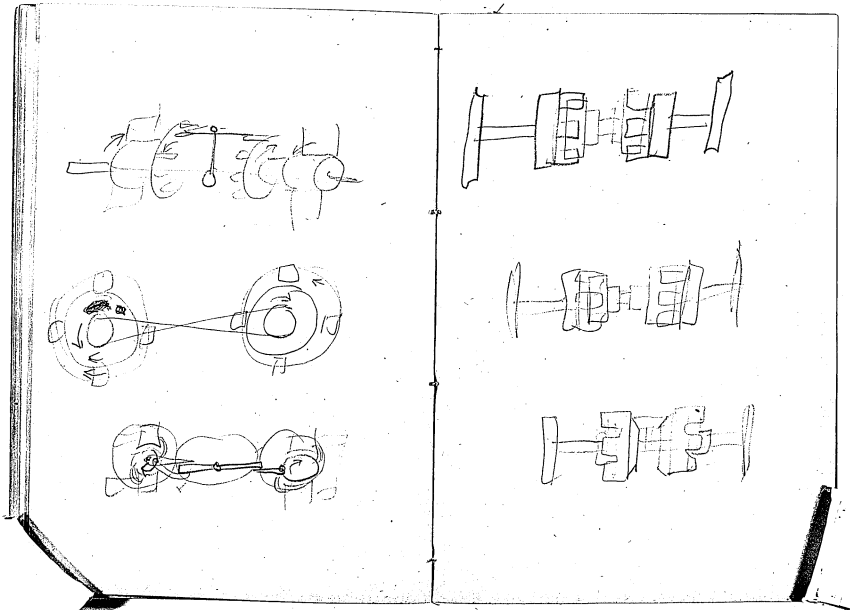
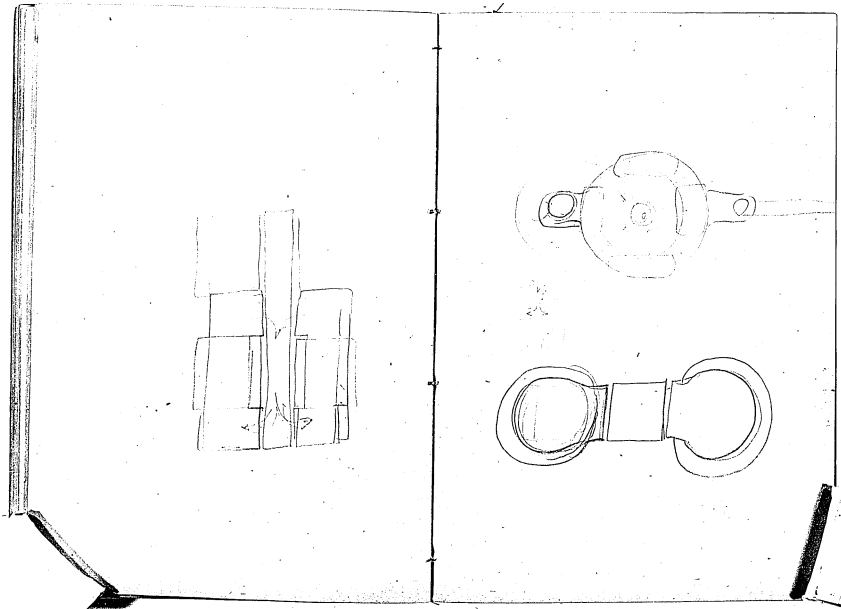


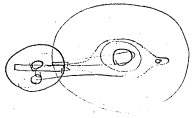


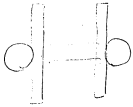
60
60
360

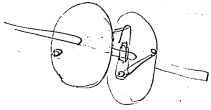
3600 / 40000 (11.
36000
4000

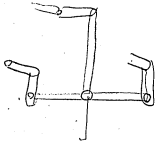


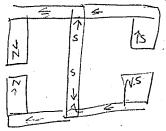











N
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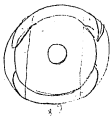

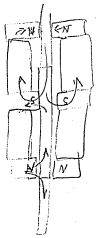
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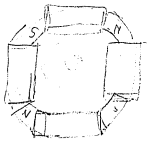
S
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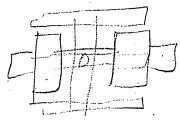
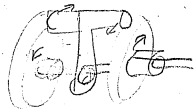
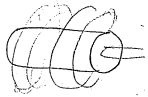
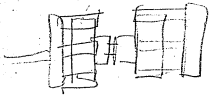
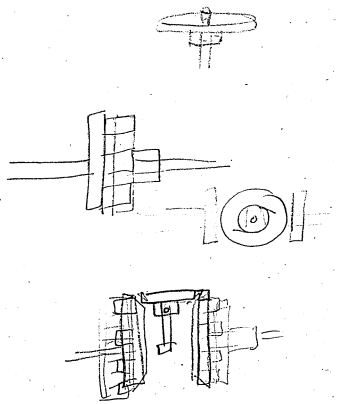
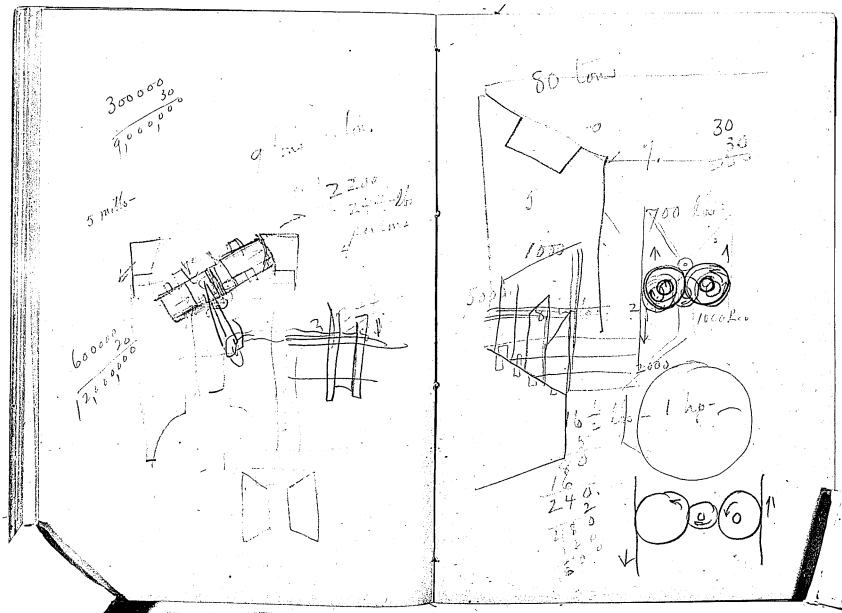


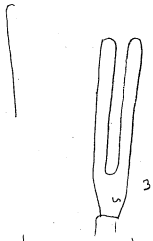









300000
30
9000000
5 mills
2200
600000
30
80 tons
30
30
700 lbs
1000
500
1000 lbs
2000
1 hp
16
24



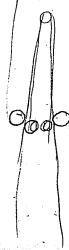
3 gram 100 cc seed
seed

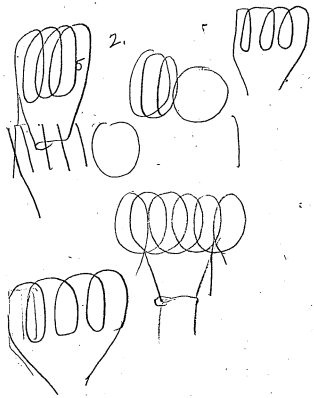
3 cc water 1 cc acid

54) 177.6 (3.29 grams
162
158
108
480
54 grams
30

66 lbs

66.





2 tons Cubic yard 10 pct 720

Mining. 7 tons. get 65 pct,
or 3 1/2 Cubic yds at. 75c — 263.
Moving to Mill. — 35
Crushing — 84
delivering Cons. the conc — 8
Taking Cons. Tailing — 14
Recleaning Conc — 25
Freight to Furnace — 110
Royalties, — 45
General Expenses. — 20

501:
Brokerage — 12

Sold at account — 585
513
72 profit

63
9
585

1000 ton Mill.

143 tons Conc. 72 c

143
130
429
143
18330
59,000

Sold 695
513
137.

60 cubic 75c 100.

75
3
225
38
2.63

62

27
13
33
37
405
320
2

124
31
155

2240) 4370 (2
4480
890

320

15

224

30.
60
175
235 000

4480
4370
110

155
27
1085
310
9124

2240) 4409 (2
4480

10.

7) 1000
143
7
1001

102
300
30,600.

143
72
286
1001
10296

60.
80
20
160
30.
300
160
32
14
40.
5700
312
1400
1400
5000
17184
1778
1556
31
5)

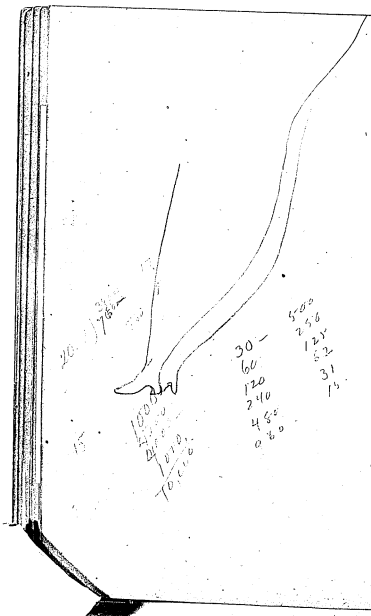
5 75
375
30
600
180
6
10
6.
3
15

10 tons. 7 pctors

Mowing	375	250
mowing to mill	50	
Wiking Cane to car	120	
Cane Tailings	5	
RR	20	
Fert Farm	25	
Royalties	110	
Final Ex Anchorage	45	
	20	
	12	
	782	
	125	
	657	
	67	
	590	

375
50
5
40
7
25
110
45
20
12
6,189,

300



Electric Welded Rails –
System with simple Motor running
Dynamos –
Double Trackage –
A general System with Central station scattered routes –
wire brush take off Current.
Chain Volts which is not the best horse